



PATENT SPECIFICATION

665,237

Date of Application and filing Complete Specification: July 22, 1949.

No. 19324/49.

Application made in Italy on Aug. 11, 1948.

Complete Specification Published: Jan. 16, 1952.

Index at acceptance:—Class 80(ii), D7b1.

COMPLETE SPECIFICATION

Continuous Speed Variator with a Small Stress of Control and a High Ratio Variation

We, PIGNONE SOCIETA PER AZIONI, of Via Panciatichi, Firenze, a body corporate organised under the laws of Italy, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a continuous speed variator of the kind comprising two discs respectively disposed one in front of the other and provided with toric surfaces and at least one wheel capable of rolling between said two discs.

In the normal continuous system speed variators or converters, in which the transmission of the motion of the driving shaft (or of the wheel) to the secondary or driven shaft, is effected by means of members which rub one against the other, so as to displace the relative position of one of these members in relation to the other, in order to vary the ratio, a considerable stress, for overcoming the frictional resistance, is generally necessary.

The object of the present invention is to provide in a speed variator of the kind referred to, the possibility of obtaining a considerable and rapid variation of the transmission ratio, without requiring a sensible stress to pass from the maximum to the minimum speed or *vice versa*, of the secondary or driven shaft, it being a characteristic that its kinematic members are in a condition of equilibrium, which can be varied with very small stresses.

With the above object in view a continuous speed variator of the kind referred to made in accordance with the present invention is characterised by the feature that the wheel is carried on a support arranged mainly externally of the discs, and rotatably mounted on the casing on a geometrical axis extending parallel to the axis of rotation of the two discs so as to provide for oscillation of the

plane passing through the maximum diameter of the wheel by merely rotating the said support.

In a preferred embodiment, the device essentially consists in suitably shaped disc elements with toric surfaces, arranged one in front of the other and rotating, for instance, on a same shaft, but independent of each other. One of them is connected to the driving shaft and the other to the secondary or driven shaft; between the two discs and in the cavity there is a wheel arranged in such a way that it is possible to vary its angular position in relation to the discs and consequently displace its points of contact with the same discs; this wheel being held by a support arranged mainly externally of the discs and pivoted on a stationary part of the device, which support can rotate around its own axis extending parallel to the axis of the device and which furthermore can slide along this axis in a direction parallel to the axis of rotation of the device. The wheel is mounted on a pivot whose axis forms an angle with the axis on which the support is mounted on the stationary part of the device. Said angle will remain constant whatever be the inclination of the plane assumed by the wheel between the two discs. Means are provided—for instance springs—for pressing the discs against the wheel which transmits the varied motion of velocity.

The device will be better understood by the following descriptive text and by the accompanying drawings which schematically outline an embodiment of a practical application of the device.

In said drawings:

Fig. 1 illustrates a longitudinal section of the whole device along its main axis;

Fig. 2 illustrates the motion transmission wheel, in section, between the two discs and, in outside view, the relative support:

[Price 2/-]

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Fig. 3 illustrates a section along the line A—A of Fig. 2;

Fig. 4 illustrates, in a schematic way, the position of the device in the state of standstill;

Fig. 5 illustrates a view along the line B—B of Fig. 4;

Fig. 6 is a section along the line C—C of Fig. 5;

Fig. 7 illustrates the device in the state of standstill, with the wheel support rotated in relation to its axis of assembly;

Fig. 8 illustrates a view along the line D—D of Fig. 7;

Fig. 9 is a view along the line E—E of Fig. 8;

Fig. 10 illustrates the device in motion, with the support of the wheel displaced;

Fig. 11 illustrates a view along the line F—F of Fig. 10;

Fig. 12 illustrates a view along the line G—G of Fig. 11;

Fig. 13 illustrates perspectively, and partially in section, the wheel mounted on the relative support.

As shown in the embodiment illustrated, the device consists of two parts or discs 1, 2, one in front of the other and rotating independently on the same shaft, or on two coaxial shafts. One of said discs for instance, the disc 1, is connected to the driving shaft 3, and the other disc 2 to the secondary or driven shaft 4.

The parts of said discs, disposed one in front of the other, are shaped so as to provide a hollow circular section 5, which, extending along each disc, forms, in the whole, a torus. Said circular section is interrupted at a given point 6 to provide passage for one or more supports 7. Each support 7 carries, on one side, a wheel 8 which has the same external diameter as the circular section and is held by the support 7 so that its centre 9 (Fig. 1) coincides with the centre of the circular section.

The wheel 8 (Figs. 2, 3, 13) consists of the following parts; a circular rim 10 shaped externally in order to have a section of contact against the two discs 1, 2, such that it has the same diameter as the circular section formed by the same discs. Said rim 10 can rotate, with or without the interposition of a suitable ball bearing 11, on the ring 12 which is connected to the shaft 13 of the support 7 by a pivot 14. The ring 12 is allowed only to swing around said pivot 14 by means of a groove 15 which passes through the ring 12.

The support 7 suitably shaped, ends, on the external part of one of the discs, for instance 2, in a circular member 16 or axle, which, because it is fitted in a stationary part 17 of the machine, allows the support 7 to be rotated (see Fig. 7) and

translated along the axis 19 of the axle 16. The various parts are connected so that the geometrical axis 18 (Fig. 3) of the pivot 14 and the axis 19 of the pivot or axle 16, meet in a point 9 through which also the plane, corresponding to the maximum diameter of the circular rim 10 has to pass. This point also is the centre of the circular section. The pivot 14 is fixed to the support 7 so that its geometrical axis 18 forms a suitable angle β with the geometrical axis 19 (see Figs. 3 and 13).

A spring 20 bearing against the abutment 21 solid at 22 with the rotary shaft 4 presses the disc 2 against the unit comprising the wheel 8 and the latter against the disc 1, by reason of the axial sliding of the support 7 in the guide 17. This has the aim of assuring the adherence with a constant load among the three bodies 1, 2, 8.

The transmission of the motion, starting from the disc 1 takes place in the following way: the rotation of the disc 1, considered as motor, rotates by adherence, the unit comprising the wheel 8. This rotates, also by adherence, the disc 2. It is obvious that the disc 1 and the disc 2 will have opposite directions of rotation.

It is clear that in such a device, the ratio varies in accordance with the position of the wheel 8 or, better, with the angle α (Fig. 11), which its plane forms with the axis 19 parallel to the axis of rotation of the two discs 1 and 2.

In order that the transmission of the motion occurs correctly it is obvious that the wheel 8 must assume a position such that its plane passes through the line tangent at the point 9 to the circumference 9', Fig. 4, the centre of which is on the geometrical axis 23 of the shaft 4 (see for said position, especially Fig. 1 and also Figs. 5 and 6).

In order to vary the position of the wheel 8 and thus the angle α , the support 7 is rotated around the axle 16, Fig. 7. Then the plane of the wheel 8 will pass no longer, in a first moment, through the tangent to the aforesaid circumference (see Fig. 7). The motion of the motor or driving disc 1 will, by adherence, compel the wheel 8 to roll for a certain distance along an oblique line until the same wheel swinging with the ring 12 and around the pivot 14, will come into a new position, in which its plane passes through the line tangent at the point 9 to the circumference 9', the centre of which is on the geometrical axis 23 (see Figs. 1, 4, 10, 11, 12).

This is the only position of equilibrium allowed for the transmission of the motion, and it is automatically attained

by the wheel 8 when an external cause tends to make the support 7 rotate.

For the arrangement of various members, it is seen that for every position of the support 7 there corresponds only one position of the wheel 8 for a determined direction of rotation of the disc 1. The amplitude of the swinging movement of the wheel 8, which movements determine the different values of the ratio, depends on the value of the rotation of the support 7 and is affected by the angle β which the pivot 14 forms with the axis 19 of the same support 7.

The motion of said support 7 can occur without any stress, even when the unit is at a standstill. In this case the wheel 8 swings around the two points of contact with the two discs (see Figs. 7, 8, 9) without offering any resistance and reaches the position of equilibrium as soon as the driving disc 1 begins to move (see Figs. 10, 11, 12).

It is clear that, when the machine is in motion, on rotating the support 7 the position of equilibrium of the wheel is immediately attained.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A continuous speed variator of the kind comprising two discs disposed one in front of the other and provided with toric surfaces and at least one wheel capable of rolling between the two discs, characterised by the feature that the wheel is carried on a support arranged mainly externally of the discs, and rotatably mounted on the casing on a geometrical axis extending parallel to the axis of rotation of the two discs so as to provide for oscillation of the plane passing through the maximum diameter of the wheel by merely rotating the said support.

2. A continuous speed variator according to Claim 1, characterised by the feature that the geometrical axis passes through the centre of the wheel and each wheel is connected to its support by a pin, pivot, or the like, the axis of which passes through the centre of the wheel and is inclined with respect to the axis of rotation of said support so as to allow a determined orientation of the wheel for every angular position of the support.

3. A continuous speed variator according to Claim 2, characterised by the feature that each wheel is held by an arm rigid with the support, extending from outside between the two discs, and the pin, pivot, or the like engages in a ring carrying the wheel, and is secured to said arm, said ring having a groove to allow the ring, and thus the wheel, to oscillate around the inclined pin, pivot or the like, and take up a position of equilibrium.

4. A continuous speed variator according to any one of Claims 1—3, characterised by the feature that the support for each wheel is mounted on a shaft which can, in addition to rotating around its own axis also move axially in a direction parallel to the axis of rotation of the discs.

5. A continuous speed variator device comprising two oppositely disposed discs having toric surfaces, and at least one wheel capable of rolling between said discs, a support for each wheel mainly external to said discs and mounted on a stationary casing so that it can oscillate on a geometrical axis extending through the centre of said wheel and parallel to the axis of rotation of the two discs, and be slidden along said geometrical axis, an arm forming a part of said support and penetrating into the space between the said two discs, a ring connected to said arm by means of a pin or pivot so as to be capable of oscillation thereon, the geometrical axis of the pin or pivot passing through the centre of said wheel and being inclined with respect to the geometrical axis of rotation of said support, means for rotatably connecting the wheel to the ring, at least one spring arranged to press one of the discs against the wheel and the latter against the other disc, and means for effecting rotational displacements of the support with respect to the stationary structure, in order to vary the transmission ratio between the two discs.

6. A continuous speed variator of the kind referred to constructed, arranged and adapted to operate substantially as described with reference to, and as illustrated in the accompanying drawings.

Dated this 22nd day of July, 1949.

For the Applicants,

COPE & CO.,

Chartered Patent Agents,

65, Victoria Street, London, S.W.1.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1952.

Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 2s. per copy; by post 2s. 1d. may be obtained.

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Fig. 4

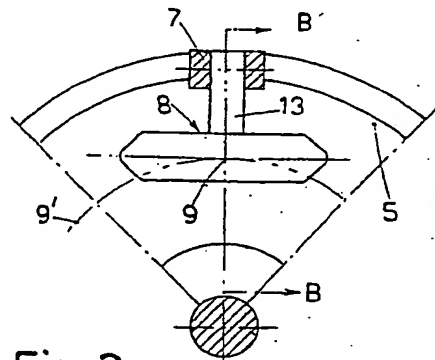


Fig. 5

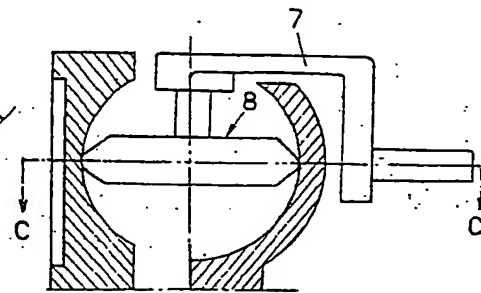


Fig. 2

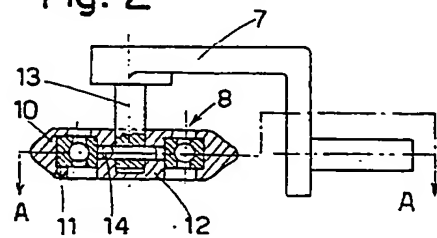


Fig. 6

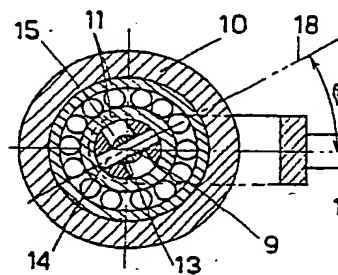
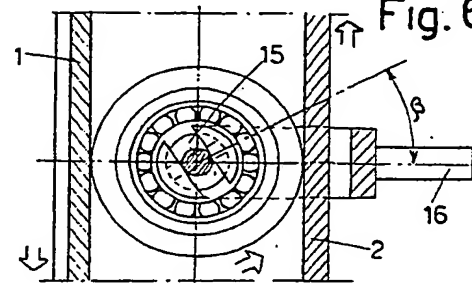


Fig. 3

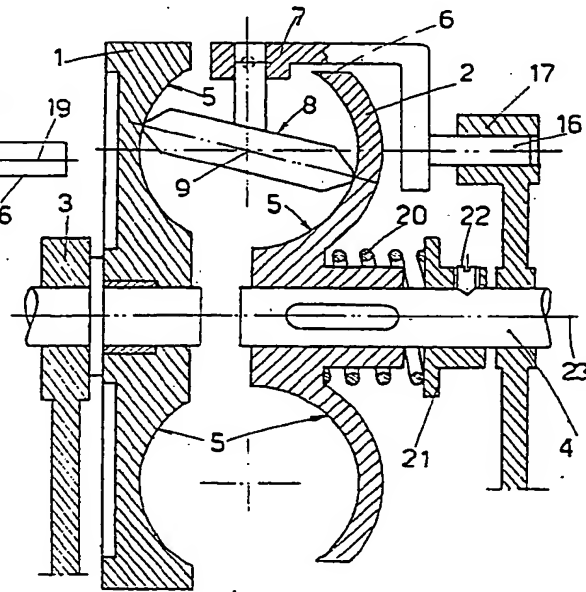


Fig. 1

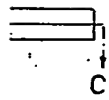


Fig. 6

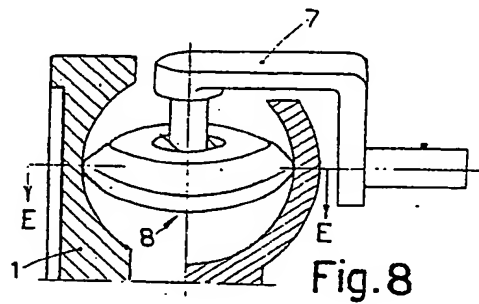
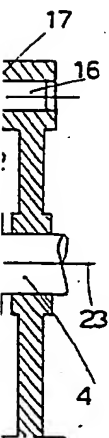
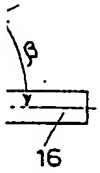


Fig. 8

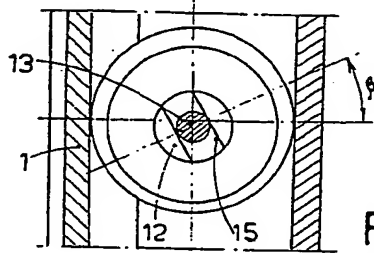


Fig. 9

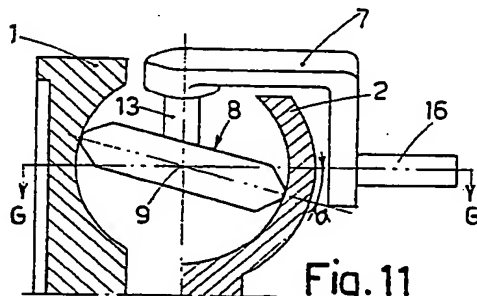


Fig. 11

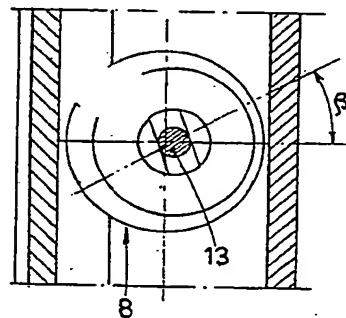


Fig. 12

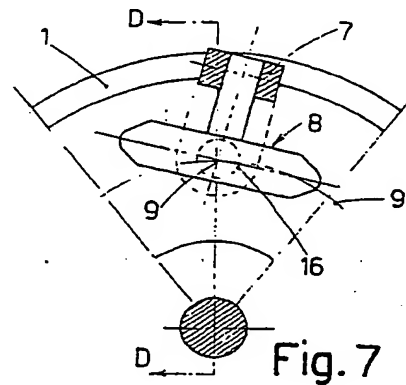


Fig. 7

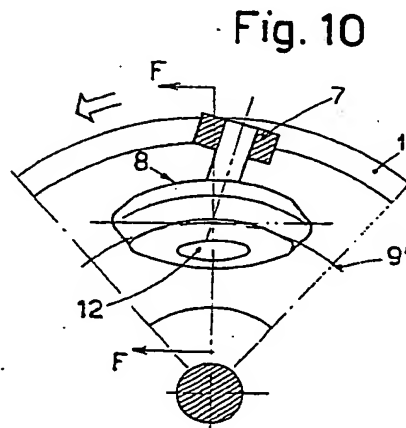


Fig. 10

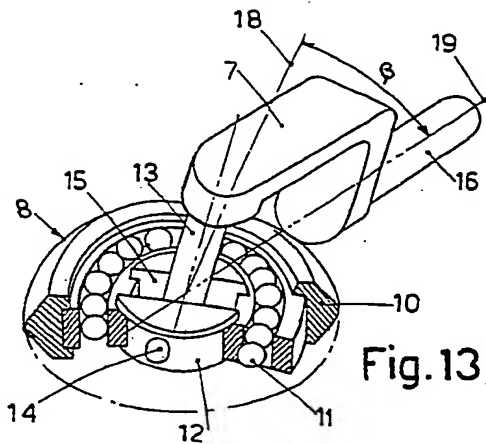


Fig. 13

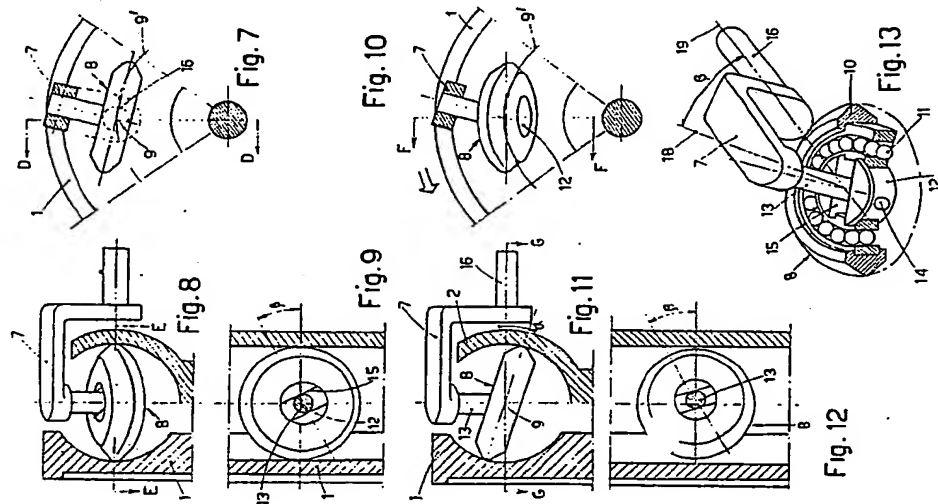
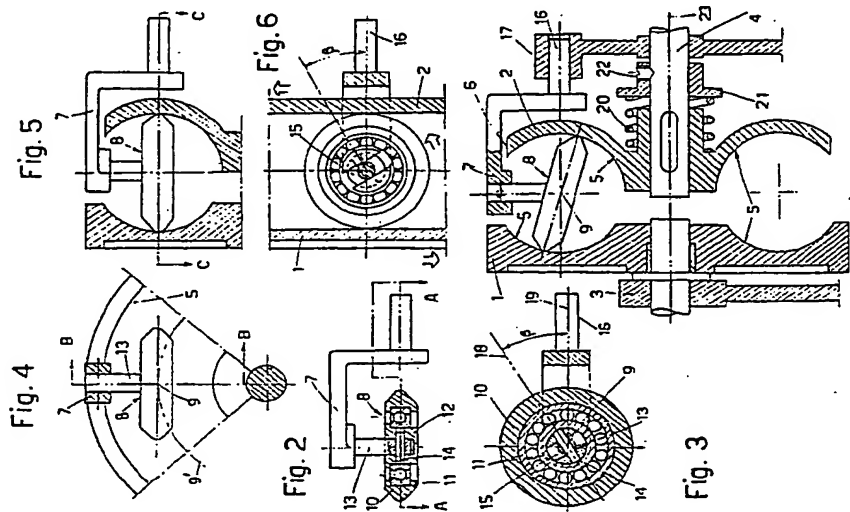
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665,237 COMPLETE SPECIFICATION

SHEET 1

25 SHEETS

SHEET 2



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